

**BEFORE THE  
PUBLIC SERVICE COMMISSION OF  
SOUTH CAROLINA  
DOCKET NO. 2017-3-E**

In the Matter of  
Annual Review of Base Rates  
for Fuel Costs for  
Duke Energy Carolinas, LLC

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**DIRECT TESTIMONY OF  
JOSEPH A. MILLER, JR. FOR  
DUKE ENERGY CAROLINAS, LLC**

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1    **Q.     PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.**

2    A.     My name is Joseph A. Miller, Jr. and my business address is 526 South Church  
3           Street, Charlotte, North Carolina.

4    **Q.     BY WHOM ARE YOU EMPLOYED AND IN WHAT CAPACITY?**

5    A.     I am Vice President of Central Services for Duke Energy Business Services,  
6           LLC ("DEBS"). DEBS is a service company subsidiary of Duke Energy  
7           Corporation ("Duke Energy"), which provides services to Duke Energy and its  
8           subsidiaries, including Duke Energy Carolinas, LLC ("DEC" or the "Company")  
9           and Duke Energy Progress, LLC ("DEP").

10   **Q.     WHAT ARE YOUR CURRENT DUTIES AS VICE PRESIDENT OF**  
11       **CENTRAL SERVICES?**

12   A.     In this role, I am responsible for providing direction and oversight for  
13           engineering and business services, along with strategic and technical services  
14           including environmental compliance planning, for Duke Energy's fleet of fossil,  
15           hydroelectric, and solar (collectively, "fossil/hydro/solar") facilities.

16   **Q.     PLEASE DESCRIBE YOUR EDUCATIONAL AND PROFESSIONAL**  
17       **BACKGROUND.**

18   A.     I graduated from Purdue University with a Bachelor of Science degree in  
19           Mechanical Engineering. I also completed twelve post graduate level courses in  
20           Business Administration at Indiana State University. My career began with  
21           Duke Energy (d/b/a Public Service of Indiana) in 1991 as a staff engineer at  
22           Duke Energy Indiana's Cayuga Steam Station. Since that time, I have held  
23           various roles of increasing responsibility in the generation engineering,  
24           maintenance, and operations areas, including the role of station manager, first at

1 Duke Energy Kentucky's East Bend Steam Station, followed by Duke Energy  
2 Ohio's Zimmer Steam Station. I was named General Manager of Analytical and  
3 Investment Engineering in 2010, and became General Manager of Strategic  
4 Engineering in 2012 following the merger between Duke Energy and Progress  
5 Energy, Inc. I became the Vice President of Central Services in 2014.

6 **Q. HAVE YOU TESTIFIED BEFORE THIS COMMISSION IN ANY**  
7 **PRIOR PROCEEDINGS?**

8 A. Yes. I testified before the Public Service Commission of South Carolina in  
9 DEC's 2015 and 2016 annual fuel proceedings in Docket Nos. 2015-3-E and  
10 2016-3-E, as well as in DEP's 2016 and 2017 annual fuel proceedings in Docket  
11 Nos. 2016-1-E and 2017-1-E, respectively.

12 **Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS**  
13 **PROCEEDING?**

14 A. The purpose of my testimony is to (1) describe DEC's fossil/hydro generation  
15 portfolio and changes made since the 2016 fuel cost recovery proceeding, as  
16 well as those expected in the near term, (2) discuss the performance of DEC's  
17 fossil/hydro facilities during the review period of June 1, 2016 through May 31,  
18 2017 (the "review period"), (3) provide information on significant fossil/hydro  
19 outages that occurred during the review period, and (4) provide information  
20 concerning environmental compliance efforts.

21 **Q. PLEASE DESCRIBE DEC'S FOSSIL/HYDRO/SOLAR GENERATION**  
22 **PORTFOLIO.**

1 A. The Company's fossil/hydro/solar generation portfolio consists of approximately  
2 14,209 megawatts ("MWs") of generating capacity, made up as follows:

3	Coal-fired -	6,764 MWs
4	Steam Natural Gas -	170 MWs
5	Hydro -	3,241 MWs
6	Combustion Turbines -	2,665 MWs
7	Combined Cycle -	1,330 MWs
8	Solar -	39 MWs

9 The coal-fired assets consist of four generating stations and a total of 13 units.  
10 These units are equipped with emissions control equipment, including selective  
11 catalytic or selective non-catalytic reduction ("SCR" or "SNCR") equipment for  
12 removing nitrogen oxides ("NO<sub>x</sub>"), and flue gas desulfurization ("FGD" or  
13 "scrubber") equipment for removing sulfur dioxide ("SO<sub>2</sub>"). In addition, all 13  
14 coal-fired units are equipped with low NO<sub>x</sub> burners. The steam natural gas unit  
15 – W.S. Lee Station ("Lee") Unit 3 – is considered to be a peaking unit.

16 The Company has a total of 31 simple cycle combustion turbine ("CT")  
17 units, of which 29 are considered the larger group providing approximately  
18 2,581 MWs of capacity. These 29 units are located at Lincoln, Mill Creek, and  
19 Rockingham Stations, and are equipped with water injection systems that reduce  
20 NO<sub>x</sub> and/or have low NO<sub>x</sub> burner equipment in use. The Lee CT facility  
21 includes two units with a total capacity of 84 MWs equipped with fast-start  
22 ability in support of DEC's Oconee Nuclear Station. The 1,330 MWs, shown  
23 earlier as "combined cycle" ("CC"), represent the Buck CC and Dan River CC  
24 facilities. These facilities are equipped with technology for emissions control

1 including SCRs, low NO<sub>x</sub> burners, and carbon monoxide/volatile organic  
2 compounds catalysts. The Company's hydro fleet includes two pumped storage  
3 facilities with four units each that provide a total capacity of 2,140 MWs, along  
4 with conventional hydro assets consisting of 86 units providing approximately  
5 1,101 MWs of capacity. The 39 MWs of solar capacity are made up of 18 roof  
6 top solar sites providing 4 MWs of relative summer dependable capacity, the  
7 Mocksville solar site providing 7 MWs of relative summer dependable capacity  
8 and the Monroe solar site providing 28 MWs of relative summer dependable  
9 capacity.

10 **Q. WHAT CAPACITY CHANGES HAVE OCCURRED WITHIN THE**  
11 **FLEET SINCE THE LAST RATE CASE?**

12 A. DEC added Mocksville Solar facility in December 2016. This facility has 15  
13 MWs of nameplate capacity which provide 7 MWs of relative summer  
14 dependable capacity. DEC added Monroe Solar facility in March 2017, which  
15 has 60 MWs of nameplate capacity and approximately 28 MWs of relative  
16 summer dependable capacity.

17 **Q. WHAT ARE DEC'S OBJECTIVES IN THE OPERATION OF ITS**  
18 **FOSSIL/HYDRO/SOLAR FACILITIES?**

19 A. The primary objective of DEC's fossil/hydro generation department is to provide  
20 safe, reliable and cost-effective electricity to DEC's Carolinas customers.  
21 Operations personnel and other station employees are well-trained and execute  
22 their responsibilities to the highest standards in accordance with procedures,  
23 guidelines, and a standard operating model. Like safety, environmental  
24 compliance is a "first principle" and DEC works very hard to achieve high level

1 results.

2 The Company complies with all applicable environmental regulations  
3 and maintains station equipment and systems in a cost-effective manner to  
4 ensure reliability. The Company also takes action in a timely manner to  
5 implement work plans and projects that enhance the safety and performance of  
6 systems, equipment, and personnel, consistent with providing low-cost power  
7 options for DEC's customers. Equipment inspection and maintenance outages  
8 are generally scheduled during the spring and fall months when customer  
9 demand is reduced due to milder temperatures. These outages are well-planned  
10 and executed with the primary purpose of preparing the unit for reliable  
11 operation until the next planned outage.

12 **Q. PLEASE EXPLAIN THE TERM "HEAT RATE" AND WHAT WAS**  
13 **THE HEAT RATE FOR DEC'S COAL-FIRED FLEET AND**  
14 **COMBINED CYCLES DURING THE TEST PERIOD?**

15 A. Heat rate is a measure of the amount of thermal energy needed to generate a  
16 given amount of electric energy and is expressed as British thermal units ("Btu")  
17 per kilowatt-hour ("kWh"). A low heat rate indicates an efficient fleet that uses  
18 less heat energy from fuel to generate electrical energy. Over the review period,  
19 the average heat rate for DEC's coal fleet was 9,350 Btu/kWh. Based on  
20 operating performance data for 2015 that was published in the December 2016  
21 issue of *Power Engineering* magazine, DEC's Belews Creek Steam Station  
22 ("Belews Creek"), Marshall Steam Station ("Marshall") and Rogers Energy  
23 Complex ("Cliffside") ranked as the third, fifth, and sixth most efficient coal-  
24 fired generating stations in the nation with heat rates of 9,212 Btu/kWh, 9,292

1 Btu/kWh, and 9,301 Btu/kWh, respectively. These results compare favorably to  
2 the average heat rate of 10,500 Btu/kWh for North American coal generators,  
3 also reported in the above noted magazine. For the review period, the Belews  
4 Creek units provided 40 percent of coal-fired generation for DEC, with the  
5 Marshall units providing 33 percent.

6 **Q. HOW MUCH GENERATION DID EACH TYPE OF**  
7 **FOSSIL/HYDRO/SOLAR GENERATING FACILITY PROVIDE FOR**  
8 **THE REVIEW PERIOD AND HOW DOES DEC UTILIZE EACH TYPE**  
9 **OF GENERATING FACILITY TO SERVE CUSTOMERS?**

10 A. The Company's system generation totaled 99,462,948 MW hours ("MWhs") for  
11 the review period. The fossil/hydro fleet provided 39,202,348 MWhs, or  
12 approximately 39 percent of the total generation. The breakdown includes a 28  
13 percent contribution from the coal-fired stations, approximately 10 percent from  
14 CC operations, 1 percent contribution for the CTs, and 0.4 percent from the  
15 hydro facilities and solar facilities.

16 The Company's portfolio includes a diverse mix of units that, along with  
17 additional nuclear capacity, allow DEC to meet the dynamics of customer load  
18 requirements in a logical and cost-effective manner. Additionally, DEC has  
19 utilized the Joint Dispatch Agreement ("JDA"), which allows generating  
20 resources for DEC and DEP to be dispatched as a single system to enhance  
21 dispatching at the lowest possible cost. The cost and operational characteristics  
22 of each unit generally determine the type of customer load situation (e.g., base  
23 and peak load requirements) that a unit would be called upon, or dispatched, to  
24 support.

1    **Q.    HOW DID DEC COST EFFECTIVELY DISPATCH THE DIVERSE MIX**  
2    **OF GENERATING UNITS DURING THE REVIEW PERIOD?**

3    A.    The Company, like other utilities across the U.S., has experienced a change in  
4    the dispatch order for each type of generating facility due to favorable  
5    economics resulting from the low pricing of natural gas. Further, the addition of  
6    new CC units within the Carolinas' portfolio in recent years has provided DEC  
7    with additional natural gas resources that feature state-of-the-art technology for  
8    increased efficiency and significantly reduced emissions. These factors promote  
9    the use of natural gas and provide real benefits in cost of fuel and reduced  
10   emissions for customers.

11   **Q.    PLEASE DISCUSS THE OPERATIONAL RESULTS FOR DEC'S**  
12   **FOSSIL/HYDRO/SOLAR FLEET DURING THE REVIEW PERIOD.**

13   A.    The Company's generating units operated efficiently and reliably during the  
14   review period. Several key measures are used to evaluate the operational  
15   performance depending on the generator type: (1) equivalent availability factor  
16   ("EAF"), which refers to the percent of a given time period a facility was  
17   available to operate at full power, if needed (EAF is not affected by the manner  
18   in which the unit is dispatched or by the system demands; it is impacted,  
19   however, by planned and unplanned (*i.e.*, forced) outage time); (2) net capacity  
20   factor ("NCF"), which measures the generation that a facility actually produces  
21   against the amount of generation that theoretically could be produced in a given  
22   time period, based upon its maximum dependable capacity (NCF *is* affected by  
23   the dispatch of the unit to serve customer needs); (3) equivalent forced outage  
24   rate ("EFOR"), which represents the percentage of unit failure (unplanned

1 outage hours and equivalent unplanned derated<sup>1</sup> hours); a low EFOR represents  
 2 fewer unplanned outage and derated hours, which equates to a higher reliability  
 3 measure; and, (4) starting reliability (“SR”), which represents the percentage of  
 4 successful starts.

5 The following chart provides operational results categorized by generator  
 6 type, as well as results from the most recently published North American  
 7 Electric Reliability Council (“NERC”) Generating Unit Statistical Brochure  
 8 (“NERC Brochure”) representing the period 2011 through 2015. The NERC  
 9 data reported for the coal-fired units represents an average of comparable units  
 10 based on capacity rating. Overall, the data in the chart reflects that DEC results  
 11 were better than the NERC five-year comparisons.

Generator Type	Measure	Review Period	2011-2015	Nbr of Units
		DEC Operational Results	NERC Average	
Coal-Fired Test Period	EAF	80.4%	79.9%	791
	NCF	46.4%	60.1%	
	EFOR	7.0%	8.1%	
Coal-Fired Summer Peak	EAF	85.2%	n/a	n/a
Total CC Average	EAF	93.3%	84.6%	309
	NCF	81.9%	51.6%	
	EFOR	0.31%	5.8%	
Total CT Average	EAF	91.1%	87.0%	876
	SR	100.0%	97.8%	
Hydro	EAF	85.9%	81.9%	1,141

<sup>1</sup> Derated hours are hours the unit operation was less than full capacity.

1   **Q.   PLEASE DISCUSS SIGNIFICANT OUTAGES OCCURRING AT DEC'S**  
2       **FOSSIL/HYDRO/SOLAR FACILITIES DURING THE REVIEW**  
3       **PERIOD.**

4    A.   In general, planned maintenance outages for all fossil and larger hydro units are  
5       scheduled for the spring and fall to maximize unit availability during periods of  
6       peak demand. Most of these units had at least one small planned outage during  
7       this review period to inspect and maintain plant equipment.

8               Belews Creek Units 1 and 2 completed outages in Fall 2016. The  
9       Belews Creek Unit 1 outage involved boiler inspections and repairs and  
10      shielding on the horizontal reheater. The primary purpose of the Belews Creek  
11      Unit 2 outage was to install weld overlay on the side walls of the boiler, replace  
12      the SCR roof, and conduct feedwater heater maintenance. Cliffside Unit 6  
13      completed an outage in the Fall 2016 replacing an induced draft fan rotor and  
14      performed cooling tower fan inspections. Allen Unit 4 completed a major boiler  
15      overhaul outage in the Fall 2016.

16             Marshall Unit 3 and Unit 4 completed outages in the Spring 2017. The  
17      primary purpose of the Unit 3 outage was to perform main turbine rotor and  
18      boiler feed pump inspections. The Unit 4 outage was to perform FGD  
19      maintenance. Allen Unit 3 completed an outage in Spring 2017 to replace the  
20      LP turbine rotor.

21   **Q.   HOW DOES DEC ENSURE EMISSIONS REDUCTIONS FOR**  
22       **ENVIRONMENTAL COMPLIANCE?**

23    A.   The Company has installed pollution control equipment in order to meet various  
24       current federal, state, and local reduction requirements for NO<sub>x</sub> and SO<sub>2</sub>

1 emissions. The SCR technology that DEC currently operates on the coal-fired  
2 units uses ammonia or urea for NO<sub>x</sub> removal. The SNCR technology employed  
3 at Allen station and Marshall units 1, 2 and 4 injects urea into the boiler for NO<sub>x</sub>  
4 removal. All DEC coal units have wet scrubbers installed which use crushed  
5 limestone for SO<sub>2</sub> removal. Cliffside 6 has a state-of-the-art SO<sub>2</sub> reduction  
6 system which couples a wet scrubber (e.g., limestone) and dry scrubber (e.g.,  
7 quicklime). SCR equipment is also an integral part of the design of the Buck  
8 and Dan River CC Stations in which aqueous ammonia is introduced for NO<sub>x</sub>  
9 removal.

10 Overall, the type and quantity of chemicals used to reduce emissions at  
11 the plants varies depending on the generation output of the unit, the chemical  
12 constituents in the fuel burned, and/or the level of emissions reduction  
13 required. The Company is managing the impacts, favorable or unfavorable, as a  
14 result of changes to the fuel mix and/or changes in coal burn due to competing  
15 fuels and utilization of non-traditional coals. Overall, the goal is to effectively  
16 comply with emissions regulations and provide the optimal total-cost solution  
17 for operation of the unit. The Company will continue to leverage new  
18 technologies and chemicals to meet both present and future state and federal  
19 emission requirements including the Mercury and Air Toxics Standards  
20 ("MATS") rule. MATS chemicals that DEC uses when required to reduce  
21 emissions include, but may not be limited to, activated carbon, mercury  
22 oxidation chemicals, and mercury re-emission prevention chemicals. Company  
23 witness McGee provides the cost information for DEC's chemical use and  
24 forecast.

- 1    **Q.    DOES THIS CONCLUDE YOUR PRE-FILED DIRECT TESTIMONY?**
- 2    **A.    Yes, it does.**